

Walpole, New Hampshire-
Westminster, Vermont Bridge
(Walpole Village Bridge)
Spans the Connecticut River
between New Hampshire & Vermont
on NH State Route 123
Walpole
Cheshire, NH & Windham, VT Counties
New Hampshire

HAER No. NH-13

HAER
NH,
3-WALP.V,
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

WALPOLE, NEW HAMPSHIRE-WESTMINSTER, VERMONT BRIDGE

(WALPOLE VILLAGE BRIDGE)

HAER No. NH- 13

HAER
NH,
3-WALP.V,
1-

Location: Spanning the Connecticut River between New Hampshire and Vermont on NH State Route 123, in Cheshire (N.H.) and Windham (Vt.) counties, just west of the village of Walpole, N.H.

USGS Bellows Falls Quadrangle New Hampshire-Vermont
UTM Coordinates: Zone 18 Easting 708840 Northing 4773175

Date of Construction: 1910-1911

Engineer: Joseph R. Worcester - J. R. Worcester & Company

Contractors: Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.
J. J. Fitzgerald, North Walpole, N.H.

Present Owner: Department of Transportation, State of N.H., Concord, N.H.

Present Use: Vehicular bridge (closed); removed May, 1988

Significance: The Walpole-Westminster bridge is significant in the history of transportation in the Connecticut River valley and in the evolution of 19th - early 20th century bridge engineering. The bridge, erected in 1910, is located on the site of the third bridge to span the Connecticut River (1807). The structure is a part of a continuum of wooden, covered, and steel spans at this crossing, which have contributed to the development of the regional transportation network and the economy of the Connecticut River valley. Adapted from railroad bridge designs for its strength, economy, and low maintenance cost, this through-plate girder span is the largest example (448') of its type in the state highway system, and is one of only two such structures (of 35 bridges) which cross the Connecticut River. The Walpole-Westminster bridge is also significant for its association with its designer, Joseph R. Worcester, the noted early 20th century structural engineer of steel and reinforced structures and foundations, and designer of several other Connecticut River bridges, including the former Arch Bridge at North Walpole, N.H.

Project Information: This documentation was undertaken in May, 1988, as a mitigative measure prior to the replacement of the Walpole-Westminster bridge and the planned removal/partial reconstruction of the existing structure in Campton, N.H. Bridge replacement project No. DE-0200(802), 10779. Prepared by Christopher W. Closs, Closs Planners Inc., Concord, N.H., for the N.H. Department of Transportation, Concord, N.H.

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 2)

1. Site Features and Historical Background

The Walpole, New Hampshire/Westminster, Vermont bridge, or Village bridge, as it is known locally, is located in the Connecticut River Valley approximately three and one-half miles south of Bellows Falls, Vermont. The bridge, which spans the Connecticut River, links the villages of Walpole and Westminster Station via New Hampshire Route 123, and is a vital link in the regional highway transportation network, which provides access between the two states and, prior to development of the inner state highway system, provided connection between southern New England and Canada.

The bridge lies within the floodplain of the Connecticut River, New England's largest, amidst the pastoral setting of fertile agricultural bottom lands and small, picturesque villages. The Connecticut River, which originates in Pittsburgh, New Hampshire, empties into Long Island Sound, 407 miles distant, and drains an area of 5,493 square miles north of the bridge (as measured at North Walpole, New Hampshire).

The lower Connecticut River Valley, which became known as "the bread basket of New England," began to be developed for agriculture in the late seventeenth century. During the eighteenth and early nineteenth centuries, the river served as the principal highway for settlement of the upper valley corridor comprising eastern Vermont and western New Hampshire. Navigable as far north as Orford, New Hampshire, the Connecticut River provided a cheap and relatively efficient means of shipping produce and raw materials to market. During the late seventeenth and early eighteenth centuries, settlement in the central and upper valley was slowed by frontier hostilities, the Revolutionary War, and the War of 1812.

Bellows Falls, Vermont (Town of Rockingham), Westminster and Walpole, New Hampshire were all chartered in 1752 by Governor Benning Wentworth. New Hampshire and New York both claimed the territory which lay west of the Connecticut River during the eighteenth century until Vermont became a state in 1791.

Following the close of the Revolutionary War in 1783, prosperity created by agricultural expansion and new population growth accelerated the development of a network for county and state roads, turnpikes, and local highways and, where river crossings were required, toll bridges. As industry developed in the valley during the early nineteenth century and river transport was superseded by the railroads in the 1840's and 1850's, the importance of cross-river access was amplified further. Exhibit I traces the developing roadway and bridge network which evolved in Walpole and Bellows Falls Between 1781 and 1810.

The construction of bridges linking the developing routes which ran parallel to the east and west banks of the Connecticut River became a matter of government concern in the decades following the Revolutionary War. The first bridge to span the Connecticut River was erected by Colonel Enoch Hale in Bellows Falls in 1783, at the site of the present Vilas Bridge.¹ Like its successors, this structure was a toll bridge enabled by a charter from the New Hampshire Legislature to the proprietor or, in other cases, a corporation.

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH- 13 (Page 3)

The original Walpole-Westminster bridge, built in 1807, is asserted to have been the third span erected across the Connecticut River.² On June 17, 1807, a charter was granted by the New Hampshire Legislature for the erection of a bridge anywhere south of Hale's Grant at Bellows Falls and the Walpole-Westmoreland town line. At the first meeting of the corporation on July 20, 1807, in Walpole, a committee was established "to examine the river, procure a plan for a bridge and map the best route from the bridge to the village."³

The original bridge was constructed of wood, 540' in length and 28' wide, and was supported upon wooden piers. The cost was \$5852. A toll house was erected on the east side of the river at the approach to the bridge.⁴

In 1858 the original bridge was replaced by a lattice-type structure, and the stone masonry piers and abutments re-laid and raised, at a cost of \$4250.⁵ This bridge is shown during construction, in Exhibit II.

Between 1867 and 1869 the bridge was seriously damaged three times by ice and flooding, and the west abutment was undermined, apparently collapsing. The records of the toll bridge corporation, which was responsible for repairs, terminate in May, 1868.

As a result of the damage and the excessive cost of repairs, the toll bridge corporation voted to relinquish ownership of the property to the towns of Walpole and Westminster, provided that \$3000 could be raised by subscription, Walpole to assume two-thirds of this figure; and that the towns rebuild the structure with tax money and thereafter maintain it as a free bridge.⁶ Following considerable debate, this plan was carried out and the new bridge opened to traffic in the fall of 1870 - the first free bridge to connect Cheshire County, New Hampshire and Windham County, Vermont.⁷ Exhibit III shows the road network in 1877.

This three-span covered bridge served for nearly 40 years until set afire by an arsonist on the night of April 1, 1910. Reputed to be one of the largest of its kind spanning the Connecticut River, the 300' (+) structure collapsed into the river; the center and western spans were carried downstream, while the eastern span caught on the bank and burned for 48 hours.⁸ A view of the bridge before the fire is found in Exhibit IV.

Loss of the bridge severed telephone and electrical service across the river and caused great inconvenience to the employees of the Abenague Machine Shop, who subsequently had to be carried to their place of work in boats.⁹ On May 14, 1910, a ferry was put into service about 100 yards upstream from the bridge and provided service for passengers and teams until dismantled on January 24, 1911.¹⁰

The two communities reacted swiftly to the loss of the bridge; special town meetings were held on April 21 and June 4, 1910, in Walpole. The electorate resolved to endorse the recommendations of the joint town bridge committee and to erect a steel girder bridge with a concrete floor.

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH- 13 (Page 4)

Selectmen John W. Prentiss and C.L. Sturtevant represented Walpole on this joint committee. The estimated cost was \$36,000, including repairs to piers and abutments.¹¹

On April 21, 1910, the Bellows Falls Times reported that one Arthur Norrington, of Westminster, confessed to setting the bridge afire. The case was investigated by a detective of the Pinkerton Agency.¹²

Views of the replacement bridge are found in the photographs attached and in Exhibit V.

II. Bridge Description

The Walpole-Westminster bridge is a steel, three-span, continuous through-plate girder design, 448'4" in overall length. Rated for H-15 loadings, the bridge has variable section girders and a pin-connected link or center span. Roadway width of the two-lane structure is 19'4" between curbs.

The bridge is aligned perpendicularly to the Connecticut River at an elevation of 260' (+) above sea level. The bridge deck is 55' (+) above the river bed, as measured at mid-span. The area opening of the bridge is 16,200 square feet. The maximum high water elevation which the bridge endured was 258.8', recorded in March, 1936. Relief is provided on the Vermont shore where the floodplain is expansive.

The three-span, continuous through-plate girder structure consists of 20 panels, which vary in length from 21'6" to 24'3". The Walpole span measures 158'8" in length, the link or center span 113'4"; and the Westminster span 173'2". The variable section girders range from 9'10" to 8'0" at center span.

Constructed of steel plate and angles, with connections and joints riveted together, the Walpole-Westminster bridge slopes slightly toward the Vermont shore with a grade of .85% and rests upon stone masonry abutments and two river piers. Originally constructed of granite masonry, these features were capped and later encased in concrete to reinforce their construction and resistance to flood damage. The last repairs to the piers and abutments were undertaken in 1968.

The Walpole and Westminster spans are each supported on an abutment and a (east and west) pier; the girder ends at the center are cantilevered some 25' beyond the river piers. The link span between these sections is supported entirely by eight, 5" pins (3" diameter), located in the web of the girders at the two expansion joints. Bridge expansion bearings are located at each abutment and typically consist of a steel shoe plate with a nest of eight 4" steel rollers, upon which ride the bottom flanges of the girders. Four dog bolts - 27" long, 1½" in diameter - embedded 18" into the concrete masonry secure the girder ends to the abutments. Bearings at the piers are fixed and typically consist of a cast pedestal base dog-bolted to the concrete pier cap, with a surface-planed ¾" slip plate above this, upon which the bottom flange of the girders rest.

The girders (the fabricated predecessors of the modern rolled I-beam) in each of the three spans are constructed typically with 7/16" and 3/8" steel plate for the webs, which are reinforced with vertical angle stiffeners of varying dimensions. The top and bottom flanges are built up using 6"x6"x¾" angles; both chords are reinforced at mid-span using multiple cover plates riveted to the flanges. All connections employ 7/8" rivets.

The continuous girders are connected by means of the floor beams, which are 33" deep. The width of the bridge from the center of each girder is 21'4".

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH- 13 (Page 6)

The original floor design relied upon a 8" reinforced concrete floor, without stringers. The wind bracing rods, laid in an x-plan in each panel and secured by nuts and check washers on the outside of the girder webs, were originally embedded in the concrete floor; this plan was altered to the present configuration in 1933, when the entire floor system was rebuilt.

The reconstruction of the bridge floor is the most significant alteration to the bridge's original design - although this did not change the appearance of the structure (except the configuration of structure on the underside of the bridge floor). The original concrete floor was removed in entirety. The wind bracing system of 7/8" rods was lowered 9" and left exposed; new holes were cut in the girder webs and the cast iron check washers re-used. (The original holes remain visible just above the current nut and check washer assembly.) Six 16" rolled I-beam stringers were laid on top of the existing floor beam structure along the entire length of the bridge. The new bridge deck consisted of 3" concrete Tee-grid (Type 2) and a wearing surface of 1" asphalt plank (armored type). The redesigned curbing consists of 3/8" bent plate, attached to the girder web and outside I-beam stringer (top flange), using a continuous weld.

The I-beam stringer system was also welded to the original floor beams. It was necessary to add angle stiffeners, also welded in place, to the web of each floor beam, in order to support the load of the stringers exerted on the original flanges.

There were twenty scuppers (7" x 2") in the original floor design, located in every other panel. In 1933, forty scuppers were installed, increased in size to 10" x 3".

According to the 1933 engineering drawings, the bridge girders were jacked up to a slightly higher elevation, and straightened, to line up. Historic photographs of the 1913 and 1927 floods and battered panels on the north elevation suggest that severe stream flow pressure and debris deflected the horizontal alignment of the spans and individual girders. Flood control systems have since been introduced along the Connecticut River by the U.S. Corps of Engineers. Except for the floor system, which is structurally unsound, the bridge girders are in good condition overall.

Neither the original design nor the 1933 reconstruction of the bridge deck incorporated provision for sidewalks, railings or lighting. The steelwork, originally painted black, has been repainted light green.

Many of the steel angle stiffeners, on the inside of the girder webs, bear the word "Phoenix" faintly, recording the original steel manufacturer's identity. The bridge builder's plaque, a cast iron tablet located at the southeast corner of the bridge, bolted to the south girder, bears the raised inscription "Walsh's Holyoke Steam Boiler Works Holyoke, Mass. Builders". There is no date of construction. Two other plaques, now missing,

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 7)

their location identified only by the shadow left on the girder webs, were located near the east and west ends of the bridge.

An electrical utility cable is carried across the Connecticut River on the bridge, inside of the steel curbing along the north girder.

The approaches to the Walpole-Westminster bridge have been altered significantly since 1910. Currently, the only surviving structures associated with the 1870 Village bridge are portions of the Abenague machine shop in Westminster, northwest of the approach; and the foundation ruins of the Walpole railroad station, southeast of the approach on the New Hampshire side. Traces of the original toll house and its successor, the bridge general store, vanished entirely in the period after 1953 when N.H. Rte. 12 was rebuilt/relocated and the approach rebuilt. A curved concrete retaining wall and parapet at the southeast corner of the bridge approach is all that remains of the pre-1954 site plan.

Copies of the historic photographs provide views of the Westminster span under construction, the completed bridge, c. 1911, and the New Hampshire approach during the flood of 1927.

Views of existing conditions and structural details are included in the 15 photographs attached. Exhibit VI includes bridge design details and conditions recorded by the New Hampshire State Highway Department during an inspection in 1950.

III. Design and Construction

Engineering drawings for the Walpole-Westminster bridge were prepared by J. R. Worcester & Co. of 79 Milk Street, Boston, Mass. Photocopies are attached of the original 1910 drawings, a drawing for the 1933 bridge floor reconstruction, and plans for more recent repairs.

The engineering firm was founded in 1907 by Joseph R. Worcester (1860-1943) of Waltham, Mass., one of the country's foremost engineers in the design of steel and reinforced structures and foundations.¹³ Worcester, a graduate of Harvard College, Class of 1882, was first employed as a draftsman for the Boston Bridge Works. He became the firm's engineer and remained there until 1894, when he established his own business (located at 53 State Street) as a consulting civil engineer.¹⁴ Worcester retired in 1924 but continued as a consultant until his death. His son, Thomas, joined J. R. Worcester & Co., also as a civil engineer.

The original blueprints prepared by the J. R. Worcester firm for the Walpole-Westminster bridge bear neither initials nor an engineer's stamp, but it is assumed that for a project of this magnitude the senior engineer was involved in approving the design. The Worcester firm also designed the Arch Bridge (1905) at North Walpole, N.H.-Bellows Falls, Vt. - the first steel arch to span the Connecticut River.¹⁵

Joseph R. Worcester enjoyed a distinguished career in the design of steel structures for over 60 years. He also made a significant contribution to the emerging technology of reinforced concrete structures during the early 20th century. Early in his career he designed the steel reinforcement to support the dome of the Bulfinch-designed State House in Boston, as well as several large office buildings, including 60 State Street and the Devonshire Building. Worcester also designed the train shed of the South Union Terminal in Boston. For many years he was the consulting engineer for the Boston Transit Commission. He designed most of the elevated structures of the Boston Elevated Railway, the steelwork of the subway, and the viaduct across the Charles River Dam. Other examples of his work in reinforced concrete include Harvard Stadium and the Hampden County Bridge at Springfield, Mass.

Between 1904 and 1917, Worcester served as a member of a special committee on reinforced concrete of the American Society of Civil Engineers. In 1921 he was appointed by Secretary of Commerce Herbert Hoover to a committee to formulate building codes and material standards, a position he held nearly until his death.

Worcester was a member of the American Society of Civil Engineers, a Fellow of the American Academy of Arts and Sciences, and president of the Boston Society of Civil Engineers (1908). He was an active member of the American Railway Engineer's Association, the American Society for Testing Materials, and the American Concrete Institute.

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH- 13 (Page 9)

A complete listing of bridges designed by J.R. Worcester & Co., and particularly those spanning the Connecticut River, is unknown. It is known, however, that the firm designed at least 18 bridges in Massachusetts; these are recorded in the Massachusetts Department of Public Works data base.¹⁶

The selection of a three-span, continuous through-plate girder design for the replacement bridge was influenced by several factors. Economy, strength, and a flood-proof design were the determining factors, while re-use of the existing piers and abutments were also considerations.

The plate girder design, generally specified for short span railroad bridges, (30'-125'), was feasible for vehicular use at this location because highway loadings were far less than railroad traffic and required less rigidity, thus permitting longer spans; and the existing piers (with some modifications) permitted a continuous girder design.¹⁷ Plate girder bridges were economical to fabricate but were difficult to transport in one piece in lengths exceeding 125'. Fireproof in design, plate girder structures also proved to be less costly to maintain.¹⁸

In the Walpole-Westminster bridge, the lighter load requirements of highway traffic (H-15) allowed each span to have a variable girder section, thus increasing economy in use of materials while creating a thin profile. This allowed a larger bridge opening area, an extra measure of protection against the flood-prone Connecticut River. The Walpole-Westminster bridge is the longest through-plate girder bridge across the Connecticut River linking New Hampshire and Vermont, and one of only two such structures which survive.

This example of the continuous through-plate girder highway bridge represents a transitional period in American bridge design. The plate girder form was developed during the last quarter of the nineteenth century and, in the early twentieth century, superseded many of the earlier metal patent truss designs. For intermediate spans, continuous plate girder bridges competed successfully against Pratt and Warren trusses and suspension designs but generally only where firm bedrock could be found upon which to set piers, and where the lighter loads of highway traffic were required. The plate girder, fabricated with rivets, was in turn superseded, in technology but not in form, by rolled I-beams and pre-stressed cast concrete girders. Continuous girder bridges are also one of the last twentieth century bridge types to utilize pin-connected spans - a type of connection now considered hazardous. Built nearly 80 years ago, the Walpole-Westminster bridge's variable section girders and continuous, simplified form foreshadow bridges now found throughout the modern American interstate highway network.

The Bellows Falls Times recorded the start of construction of the Walpole-Westminster bridge, in its July 28, 1910 edition:

The contract for building the new steel plate girder bridge across the river between Westminster and Walpole has been let to Walsh's Holyoke Steam Boiler Works, Holyoke, Mass., they being the lowest bidders. Other firms bidding were

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 10)

the Lewis F. Shoemaker Co., who built the arch bridge at North Walpole; the Canton Bridge Co., the Pennsylvania Steel Co.; United Construction Co.; and the Boston Boiler Works. The bids ranged from \$32,766 to \$25,978, the latter being the one accepted by the committee. This amount is about \$6,800 lower than the largest bid, and \$3,000 less than the next lowest.

John Fitzgerald of North Walpole has the contract for repairing the piers and abutments, and has already commenced work.

Daniel Connors of North Walpole has charge of the work for the committee. The Phoenix Iron Co. of Phoenixville, Penn., will furnish the steel for ... Walsh's John Fitzgerald will also, in addition to making the repairs on the piers and abutments, erect the falsework necessary in the construction and erection of the bridge.

Walsh's Holyoke Steam Boiler Works, of Holyoke, Mass., was founded in 1893 in Springfield, Mass., by W. J. Walsh. T. S. Walsh, W. J.'s brother, opened and managed the works at Holyoke beginning in 1895.¹⁹ Walsh's manufactured steam boilers, penstocks, tanks, rotary bleach boilers, iron and steel girders, fire escapes, and all kinds of plate iron work at its Mechanic Street works (near Appleton Street). The firm was absorbed by Continental Copper & Steel Industries, Inc., midway through the 20th century; it was last listed in the Holyoke directory in 1957.

The Bellows Falls Times reported on the course of construction between August 4, 1910, and October 8, 1910, as follows.²⁰ On August 4, derricks were erected on both banks of the river. E. E. Pettee from the J. R. Worcester & Co. firm arrived on August 8 to survey the site and set grades and elevations. John J. Fitzgerald constructed a raft upon which to place the pile driver, necessary to set piles in the river bed for the falsework. By September 15, the west abutment had been removed and replaced with a new concrete base, and the west pier leveled and capped with reinforced concrete. The steel for the west span arrived on October 8 and was unloaded on the Westminster approach. Eleven additional cars loaded with steel were shipped from Holyoke on October 4, destined for Walpole; this shipment was used for the center and east spans, which were erected from the New Hampshire side.

The continuing chronology of construction was recorded in the Keene (N.H.) Evening Sentinel between November 22, 1910, and January 24, 1911.²¹ By November 22, all girders were in place on the falsework and the work of riveting the span together began. Construction of the formwork for the concrete floor was underway by November 29. In December an accident occurred; some of the formwork collapsed, injuring John Fitzgerald. Pouring of the reinforced concrete floor continued through December and into January. On January 17, 1911, the concrete work was completed and covered with hay and 4" of sawdust, to prevent freeze-curing. No trotting was permitted and loads were limited, initially to 2.5 tons.

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH- 13 (Page 11)

The new bridge was opened to traffic on January 24, 1911. The ferry was discontinued and removed from the water. Painting of the steelwork and final approach grading was completed in the spring of 1911.

In 1933, the entire deck was removed and replaced. Steel stringers were introduced on top of the original floor beams and a new reinforced concrete grid floor was poured. Damage to the alignment and elevation of the bridge, resulting from the 1913 and 1927 floods, was also corrected, under the supervision of the J. R. Worcester & Co. firm.

River pier and abutment repairs were performed in 1936, 1959, and 1968.

The bridge was closed to all traffic on April 14, 1987.

Footnotes

1. Martha McAnolds Frizzell, A History of Walpole, New Hampshire, 2 vols. (Walpole, NH: Walpole Historical Society, 1963), Vol. I, p. 518.
2. George Aldrich, Walpole As It Is and As It Was (Claremont, NH: Claremont Manufacturing Co., 1880), p. 92.
3. Frizzell, p. 522.
4. Ibid., p. 522.
5. Ibid., p. 523.
6. Ibid., p. 523.
7. Bellows Falls (Vt.) Times, May 5, 1910; April 28, 1910.
8. Ibid., April 7, 1910.
9. Ibid., April 7, 1910.
10. Keene (N.H.) Evening Sentinel, January 24, 1911.
11. Bellows Falls Times, June 9, 1910.
12. Bellows Falls Times, April 21, 1910.
13. The New York Times, May 10, 1943; obituary of Joseph R. Worcester.
14. Harvard University Class of 1882, 25th Anniversary Report (Cambridge, MA: Harvard University, 1907), p. 199.
15. The Boston Herald, May 10, 1943; obituary of Joseph R. Worcester.
16. Massachusetts Department of Public Works, Boston, Mass., data base.
17. Carl W. Condit, American Building Art - The Twentieth Century (New York: Oxford University Press, 1961), pp. 5, 6.
18. David Weitzman, Traces of the Past - A Field Guide to Industrial Archeology (New York: Chas. Scribner's Sons, 1980), pp. 114, 115.
19. Holyoke Directory, 1895 edition, pp. 563, 594; 1956 edition, pp. 411, 92.
20. Bellows Falls Times, August 4, 1910; August 11, 1910; September 15, 1910; October 8, 1910.
21. Keene Evening Sentinel, November 22, 1910; November 29, 1910; January 11, 1911; January 17, 1911; January 24, 1911.

Sources Consulted

Aldrich, George, Walpole As It Is and As It Was, Claremont, NH: Claremont Manufacturing Co., 1880.

Bellows Falls (Vt.) Times, April 7, 1910; April 21, 1910; April 28, 1910; May 5, 1910; June 9, 1910; August 4, 1910; August 11, 1910; September 15, 1910; October 8, 1910.

The Boston Herald, May 10, 1943; obituary of Joseph R. Worcester.

Condit, Carl W., American Building Art - The Twentieth Century, New York: Oxford University Press, 1961.

Engineering News (Vol. LXIV), September 1, 1910, p. 10.

Frizzell, Martha McDanolds, A History of Walpole, New Hampshire, 2 vols., Walpole, NH: Walpole Historical Society, 1963.

Harvard University Class of 1882, 25th Anniversary Report, Cambridge, MA: Harvard University, 1907.

Holyoke Directory, 1890 - 1960 editions [publisher varies].

Keene (N.H.) Evening Sentinel, November 22, 1910; November 29, 1910; January 11, 1911; January 17, 1911; January 24, 1911.

Massachusetts Department of Public Works, Boston, MA: Data base.

The New York Times, May 10, 1943; obituary of Joseph R. Worcester.

Walpole, N.H., Annual Reports, 1910, 1911.

Weitzman, David, Traces of the Past - A Field Guide to Industrial Archeology, New York: Chas. Scribner's Sons, 1980.

New Hampshire Bridge Inventory Card Index. "Walpole - Westminster, Vt. - No. 132/062," May 18, 1950; six cards. N. H. Department of Transportation, Bridge Design Division.

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 14)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

BELLOWS FALLS, N. H.-VT.
N4300-W7215/15

1957

AMS 6570 III SERIES V712

WALPOLE, NH - WESTMINSTER, VT
BRIDGE NH ROUTE 123

BELLOWS FALLS QUADRANGLE
NEW HAMPSHIRE-VERMONT
15 MINUTE SERIES (TOPOGRAPHIC)

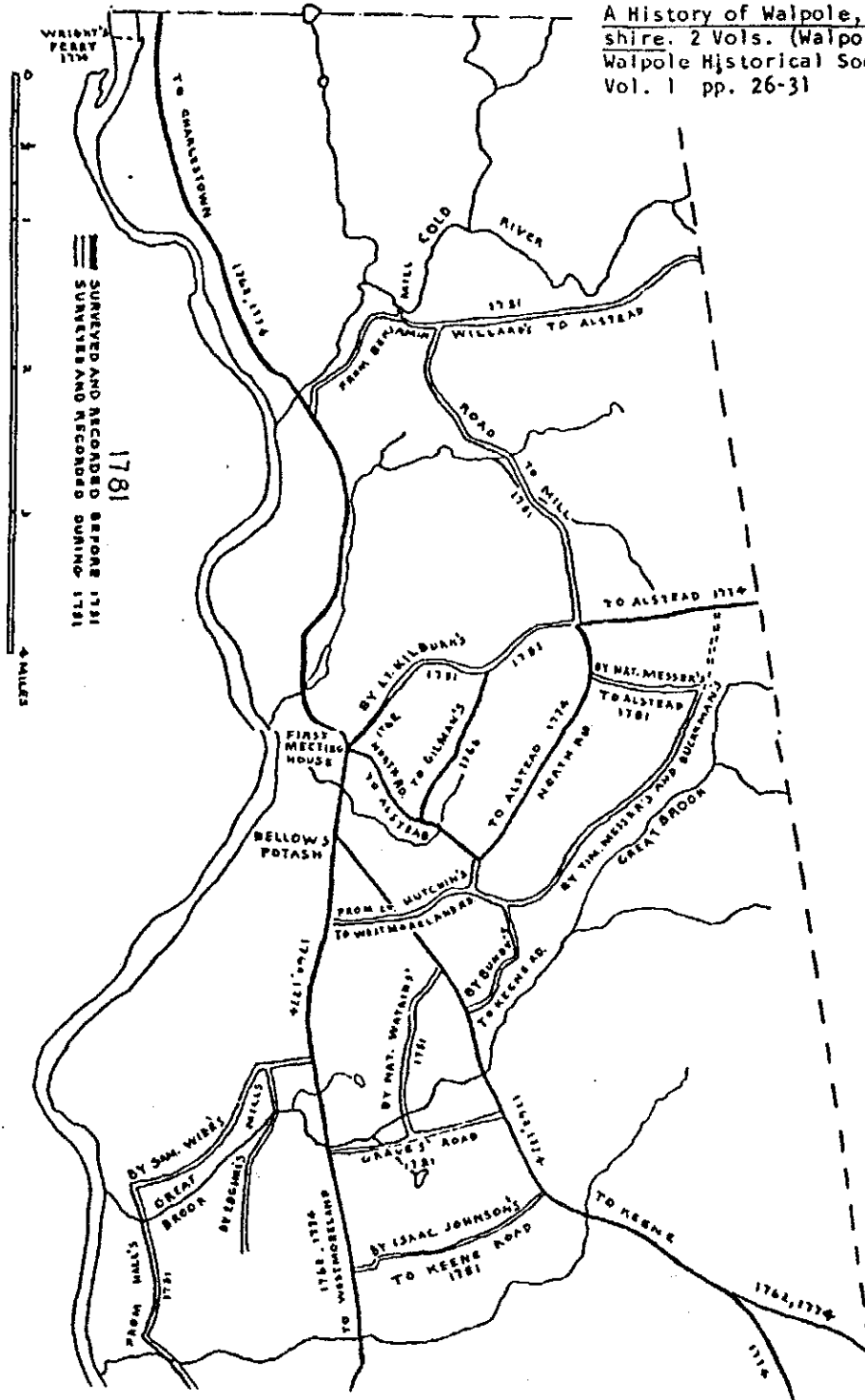
SCALE 1:62,500

VERTICAL INTERVAL 10 FEET
ELEVATION MEAN SEA LEVEL

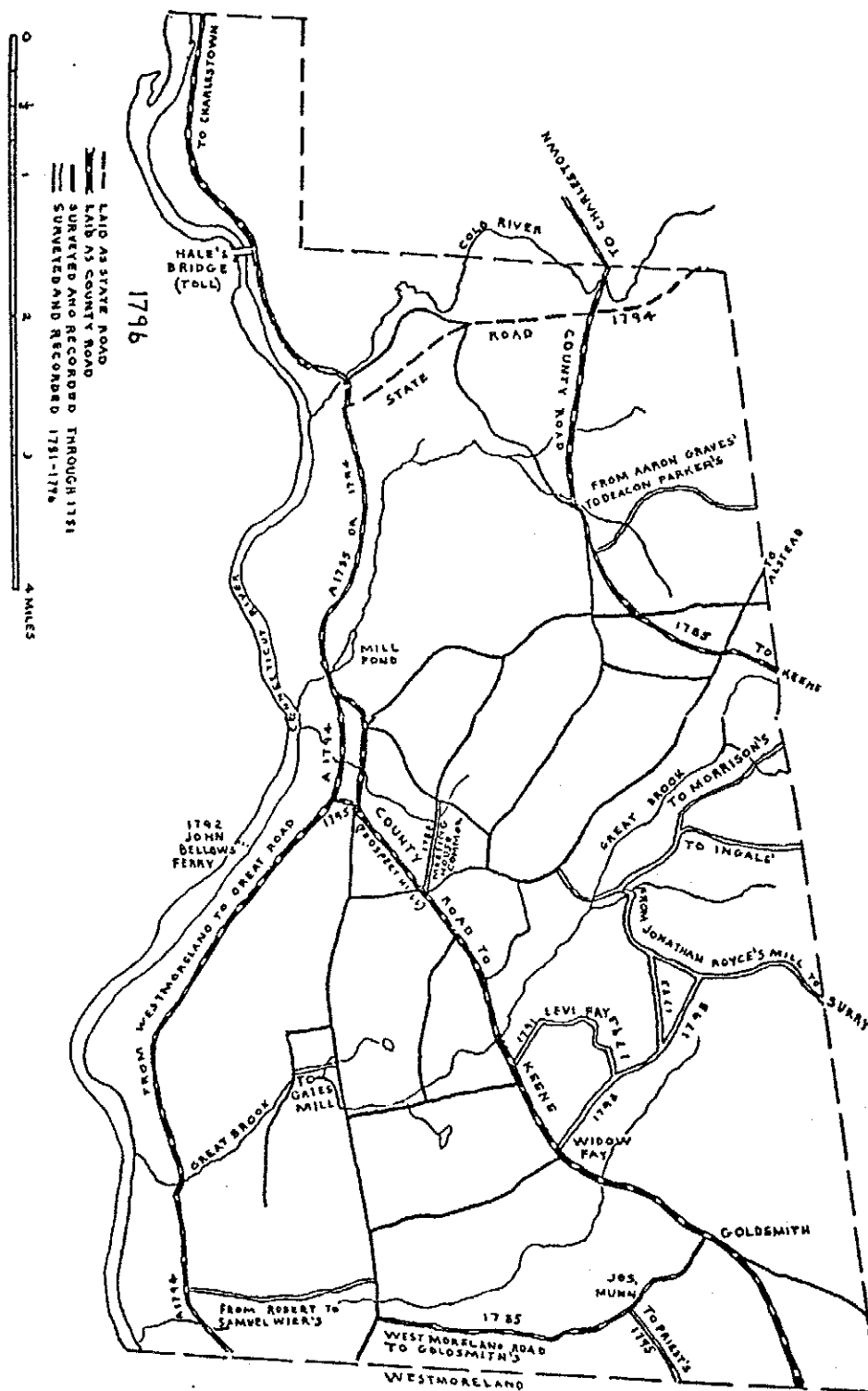
WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 15)

EXHIBIT I WALPOLE, NH 1781,
1796, 1810 Highways

Source: Martha McDanolds Frizzell,
A History of Walpole, New Hamp-
shire. 2 Vols. (Walpole, NH:
Walpole Historical Society, 1963),
Vol. 1 pp. 26-31



WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 16)



WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 17)

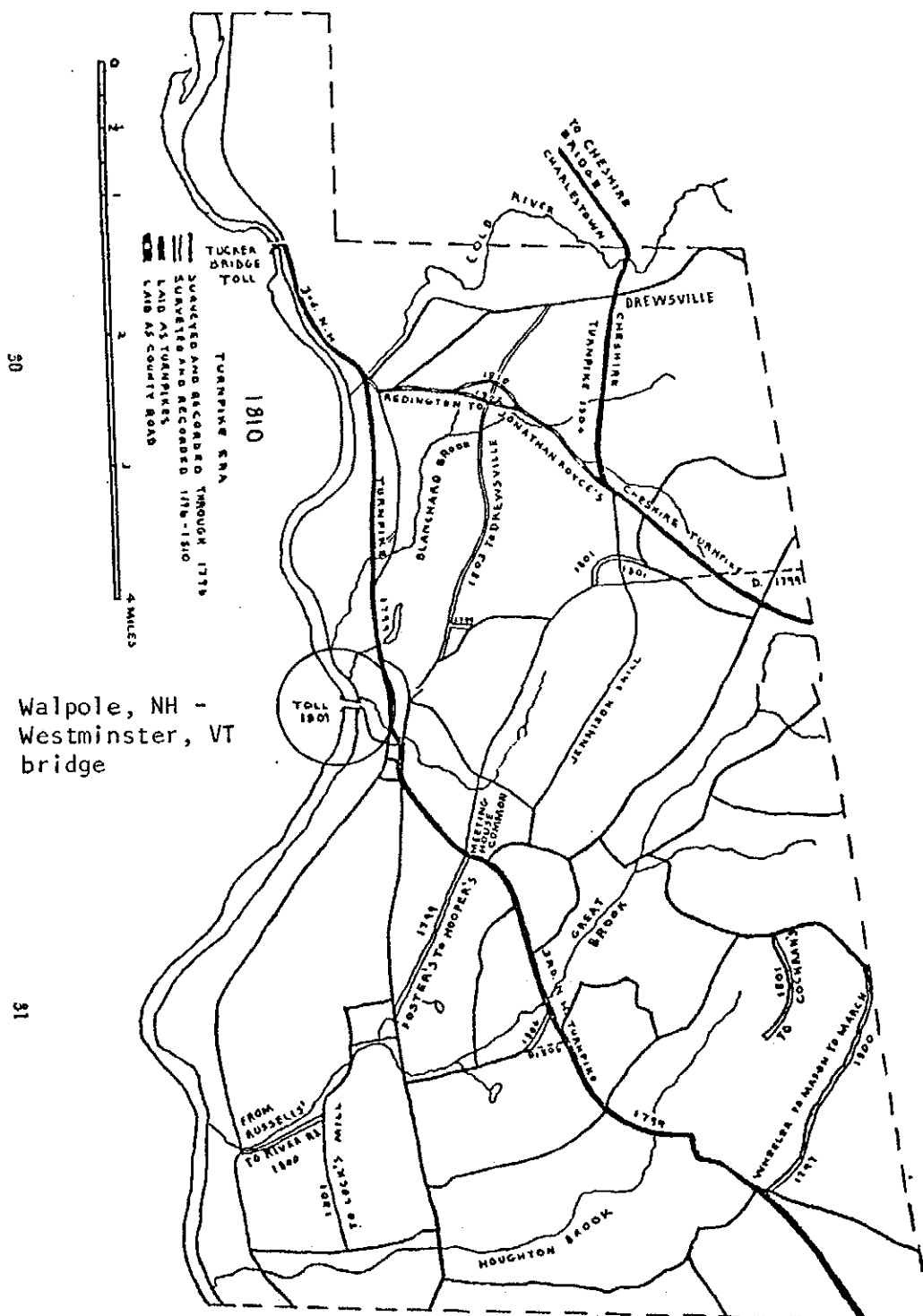


EXHIBIT 11

Untitled photograph c. 1858-69
Walpole, NH - Westminster, VT
bridge during reconstruction.

Source: Walpole Historical Society
Photograph scrapbooks
Walpole, N.H.

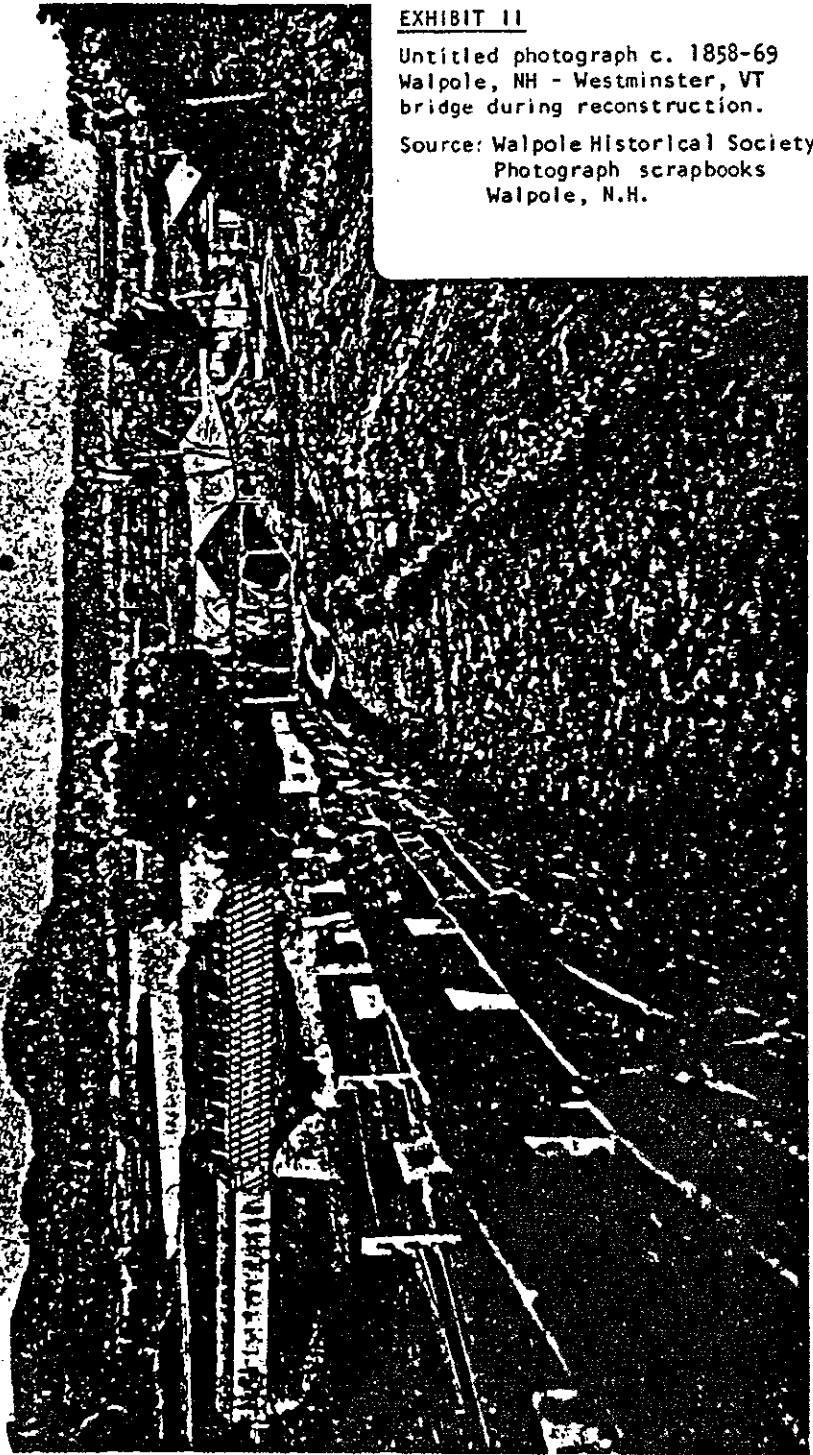


EXHIBIT III

Atlas of Cheshire County, N.H.

Walpole

C.H. Rockwood

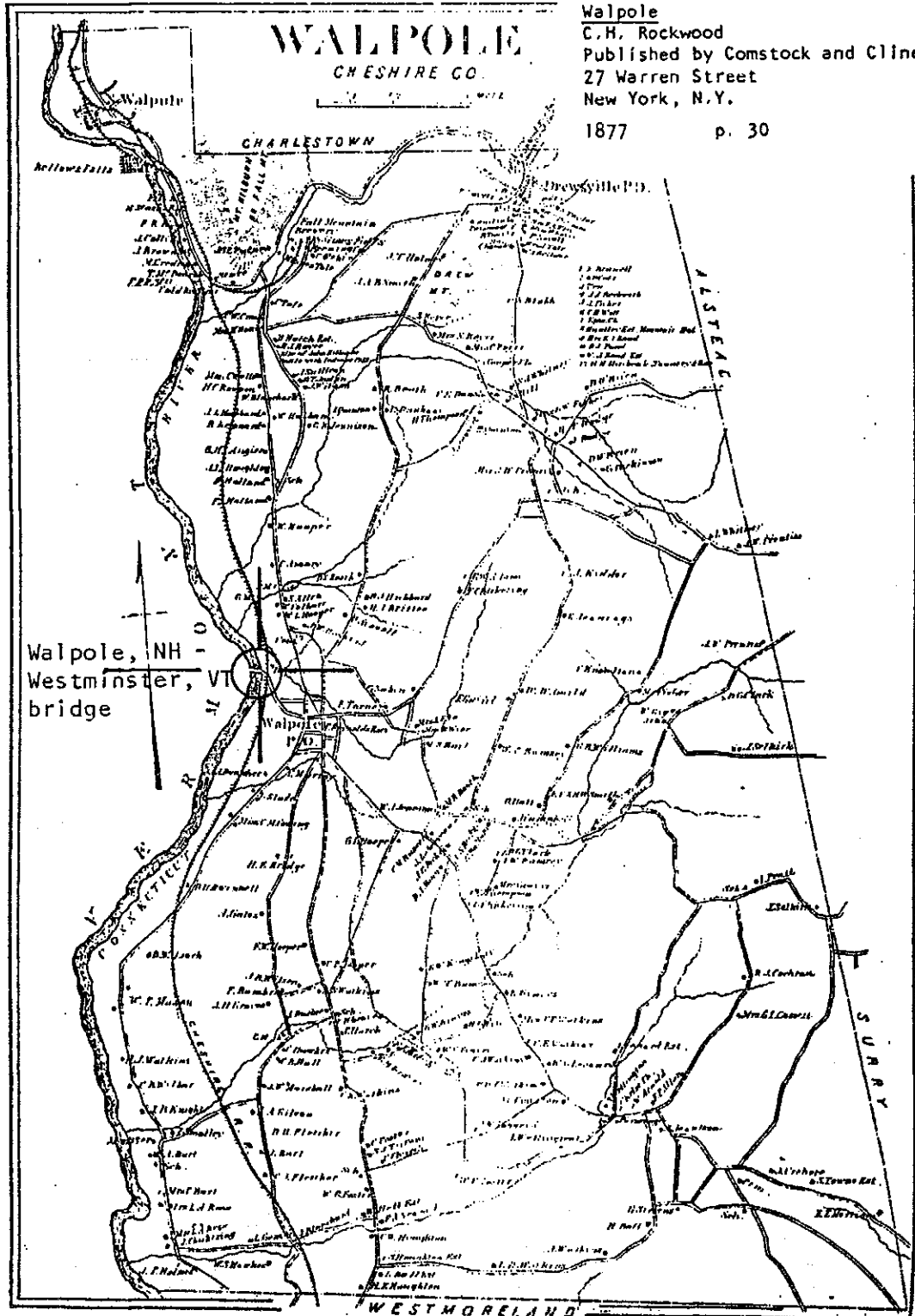
Published by Comstock and Cline

27 Warren Street

New York, N.Y.

1877

p. 30



WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 20)

EXHIBIT IV

Untitled photograph c. 1870-1910
Walpole, NH - Westminster, VT
bridge before fire of April 1,
1910.

Source: Walpole Historical Society
Photograph scrapbooks
Walpole, N.H.

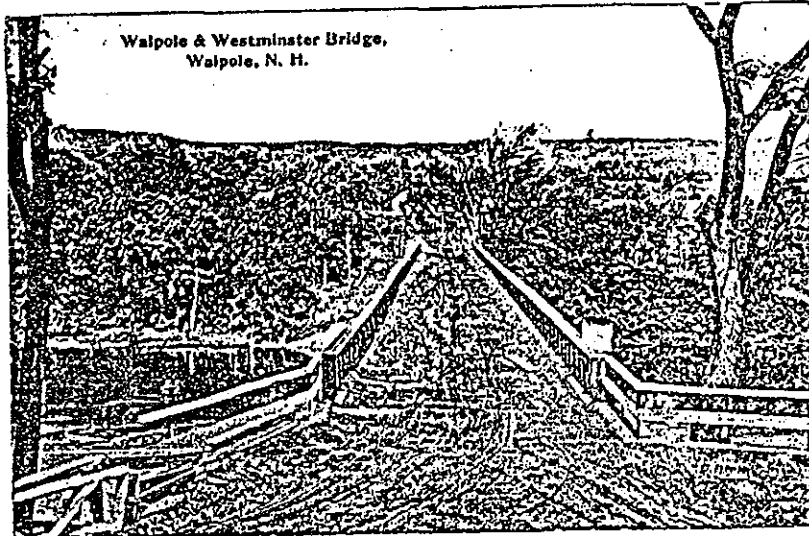


WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 21)

EXHIBIT V

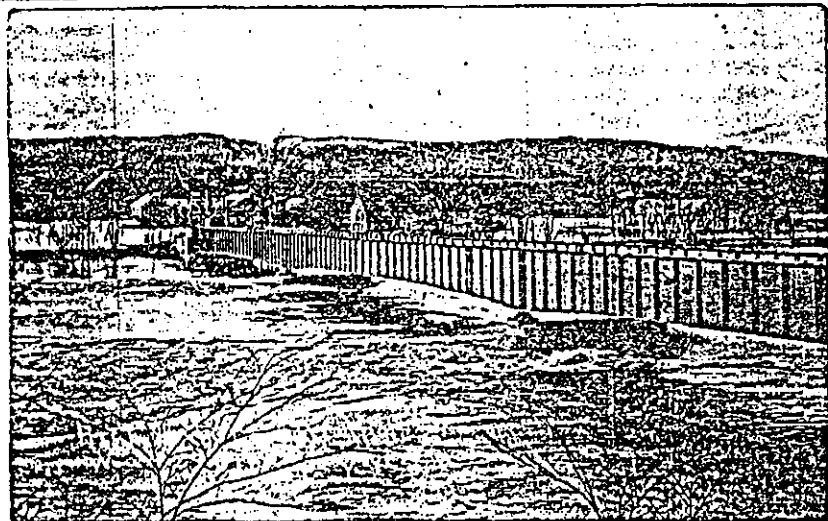
Untitled postcard photographs
c. 1911-1913 of Walpole, NH -
Westminster, VT bridge.

Source: Walpole Historical Society
Photograph scrapbooks
Walpole, N.H.

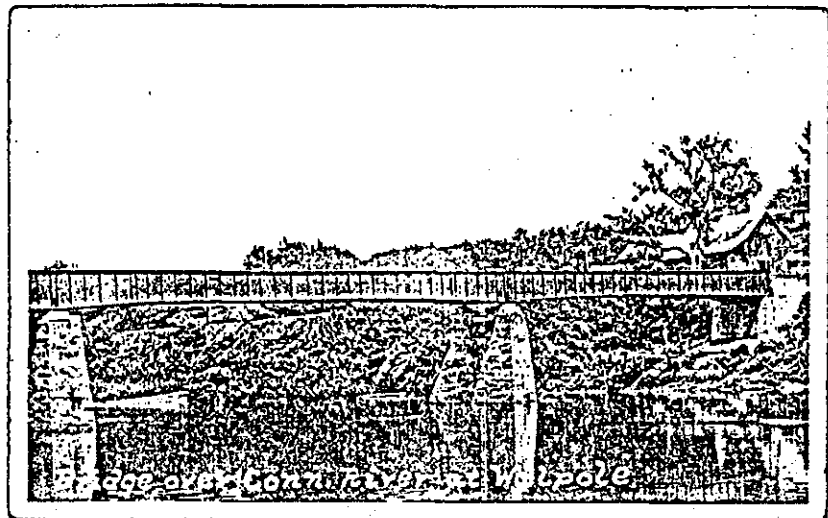


Walpole, N.H. approach
c. 1911

1913 Flood



c. 1911 south
elevation



WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 22)

EXHIBIT VI New Hampshire Bridge
Inventory Card Index

Source: NH Department of Transportation, Concord, NH

STATE HIGHWAY DEPT. DIV. 7 STEEL SPANS MADE W.H.P. 5/18/50 CARD 11/01-2
DATE 5/18/50 F.S.P. 020 CHECKED F.C.S. 5/21/50

DWR Walpole Westminister Vt. No. 132/062 BRIDGE OVER Connecticut River SPAN NO.
JATING H-15 MEMBER DESIGN LIVE REQUIRED LIVE POSTED LIVE YEAR BUILT 1910

NO. AND TYPE SPANS 3 - Thru Plate Girder 21'-4" c.c. TOTAL LENGTH 448'-9" New Floor 1933

SKEW — SUPERELEVATION CROWN 2" in 9'-8" APPROACH PAVEMENT

GENERAL	ALIGNMENT	GRADE	RIGHT DISTANCE	SPAN LENGTH	WIDTH	CLEARANCE
BRIDGE	Long	85%		E.C. BEARINGS 4452	BETWEEN CURBS 19'-4"	
REAR APPROACH				O.D. FLOOR 448'-9"	BETWEEN RAILS 20'-0"	
FORWARD APPROACH	Long			CLEAR SPAN (middle) 151'-8"	WALKS	VERTICAL open

DESIGNED BY HIGHWAY DEPT. CORP. ENG. J. R. Worcester Co. BUILT BY TOWN

MAINTAINED BY STATE TOWN RAILROAD PLANS ON FILE NOT ON FILE ROLL-ON FREE

PROJECT NO. CONTRACTOR 3-1-1-10 See also 1-12-3-1

TOTAL COST STEEL COST FLOOR SLAB COST

TRAFFIC SURVEY DATA A B C D E F G H I

WATERWAY, ELEVATION LOW BRIDGE ELEVATION MAXIMUM HIGH WATER 16'-7 3/4" AREA BRIDGE OPENING 16,700 sq'

ALIGNMENT AND CHARACTER CHANNEL Fin Gr to str bed @ midspan 55' +

REMARKS

SUBSTRUCTURE	MATERIAL	TYPE	HEIGHT	SUPPORTING MATERIAL	PILES—TYPE	NO.	SIZE	LENGTH	CAPS
REAR ABUTMENT		masonry							
FORWARD ABUTMENT		"							
PIERS OR BENTS	2	Granite Masonry							

WINGS Forced w/ concrete

REMARKS Old masonry abuts & piers capped for bridge seats +

Revised PAT. APR. 5, '23 FEB. 6, '27 R-6-C-7300-1A

SUPERSTRUCTURE MATERIAL Struct Steel SPAN TYPE Thru Plate Girder

GRADE TO BRIDGE SEAT 7'-3 1/2" (abuts) 7'-7 1/2" (piers) GRADE TO LOW STEEL 5'-0 1/8" @ midspan

DEPTH — PARALLS AT PAINT

	WEARING COURSE	FLOOR	CURB	ROAD RAIL	WALK RAIL	BEARING	
MATERIAL	asphalt plank	T-grid	Steel	Steel		EXPANSION	FIXED
TYPE		Filled	3/8" pl.	Girder		nest of 8-4" cast pedestal rollers	shoes 17 1/2" high
HEIGHT			10"				2-1 x 3-2
THICKNESS	1"	3"	12"			1 1/2" bolts	1 1/2" bolts
FASTENINGS			weld				

FLOOR DRAINAGE 40-Scuppers in curb pl 3x10 opening

REMARKS * Walpole span 136'-0", middle span 158'-8", Westminster span 150'-6" (s.s. bry)
Floor system erected 1933 consists of Filled 3 T-Grid setting on 6 lines of 16 WF @ 3'-9 1/4" (4 int @ 45", 2 ext @ 37") 16 WF stars set on top old 33" web pl. bms (max span 24'-3") 3/8" web pl. 413 3/2 x 3 1/2 x 3/8; 3 x 2 x 3/8 stiff 13" & 3/8 fill pls. Stiffener 13 welded to beams at the time T-Grid floor was installed 1933. Girders have 3/8" & 3/4" web pls with 4 1/2 x 6 x 3/4" Max height b-b 43 9'-10 1/2" min 8'-2 1/4" 5 cov pls top & bot. 16 x 1/4" Sway rods 1" & 7/8" 8-0

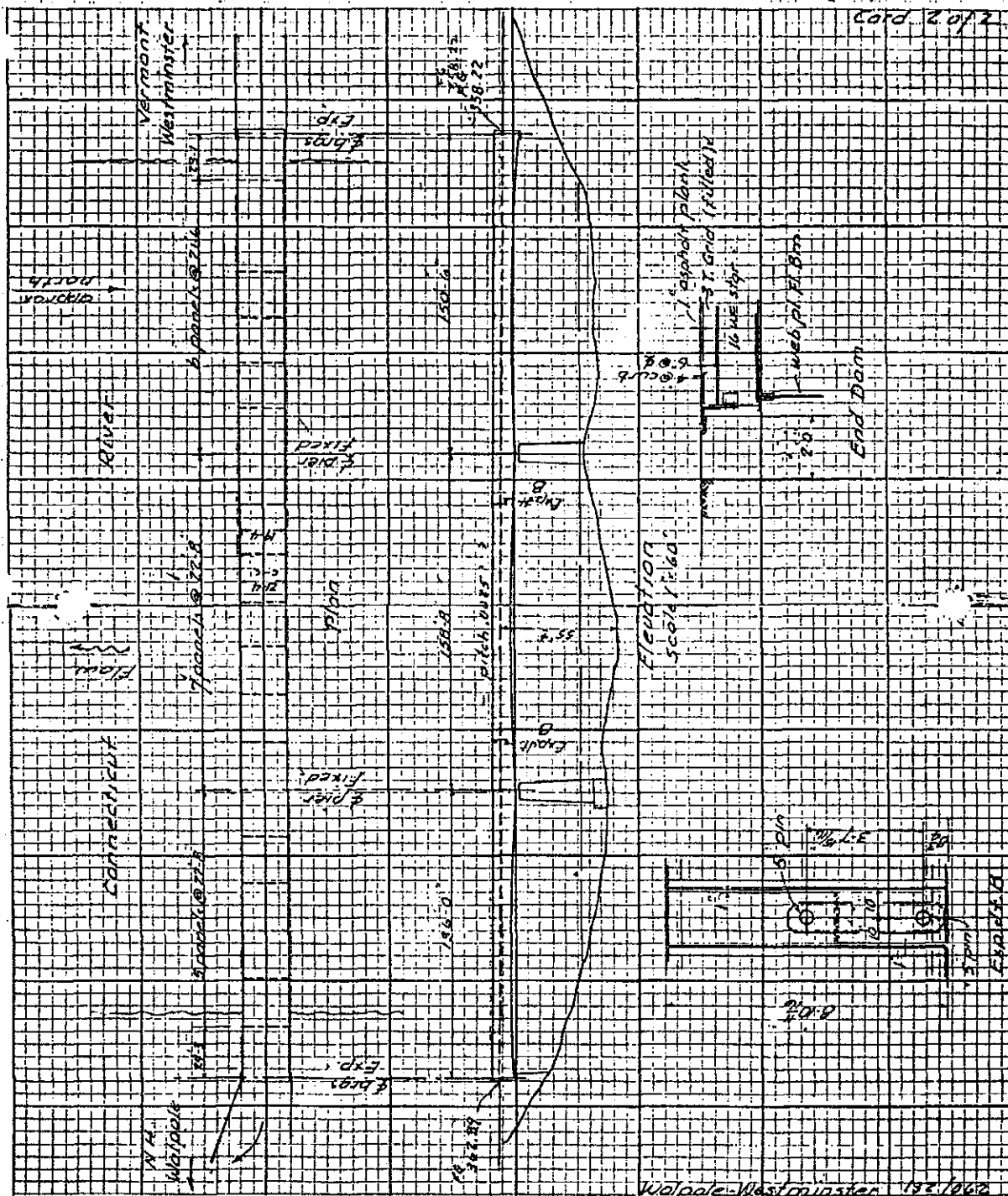
Stiffener 13 5 x 2 x 3/4" with 3/4" flange (3 angles)

Note: on date photos taken, 5/18/50, the floor is built up with peastone surface

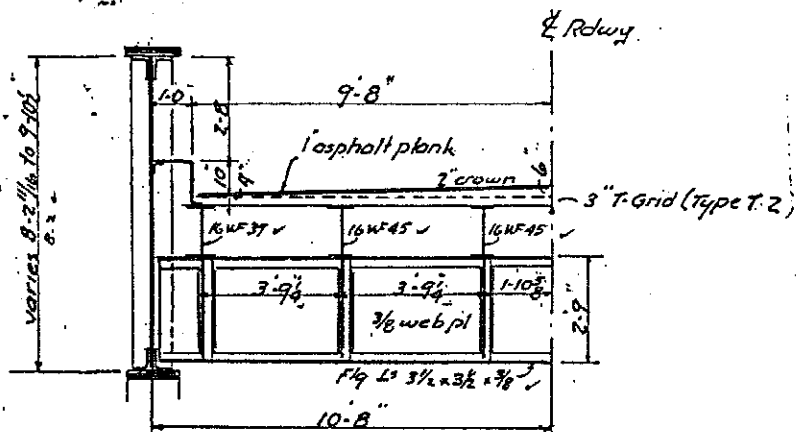
Temporary Closing - Eng. Rep. 5-6-68

TOWN	BRIDGE NO.	ROUTE	STRENGTH	CLEAR ROADWAY	VERTICAL CLEARANCE
Walpole Westminister	132/062	123	NO. HS. NO. H10. H15. H18. H20. 14-10. 18-22. 24-26. 28-30. 32-34. 36-38. 40-42. 44-46. 48-50.	10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40.	00

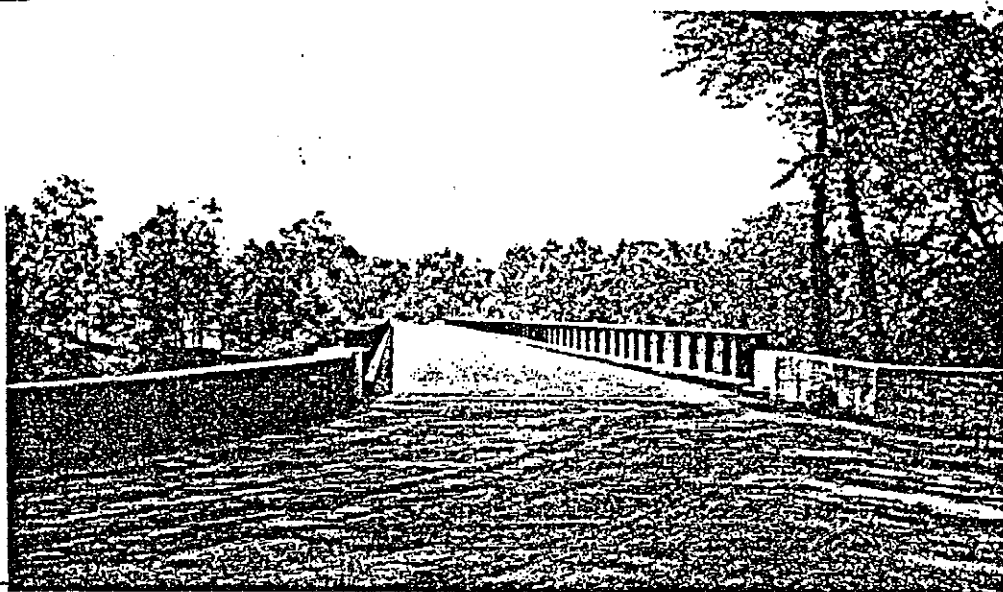
WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 23)



HAER No. NH-13 (Page 24)



2 Typical Section
Scale 1/4" = 1'-0"



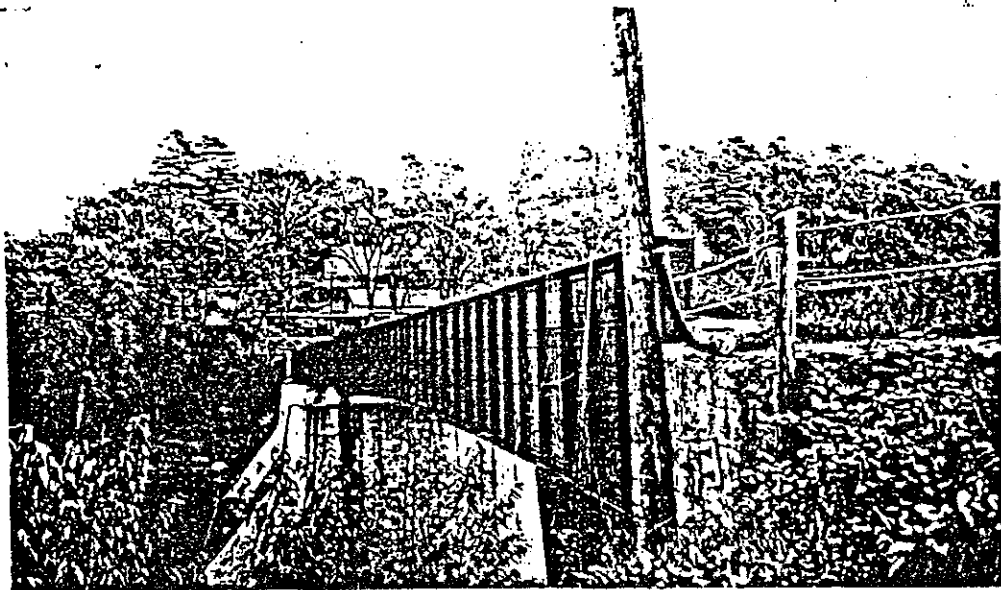
Looking toward Westminster VT



Downstream side



Looking Toward Walpole N.H.
(Westminster R.R. Station in background)



UP57 Feom 7346

[illegible]

WALPOLE, NH-WESTMINSTER, VT BRIDGE
HAER No. NH-13 (Page 27)

WATERWAY		ELEVATION	AREA BRIDGE OPENING	AREA RELIEF OPENINGS
GRADE CENTER OF BRIDGE			MAXIMUM VELOCITY OF FLOW	MAXIMUM RECORDED FLOW
LOW BRIDGE			SKREW OF FLOW (SKETCH)	DATE
LOW WATER			DRAINAGE AREA (SIZE AND CHARACTER)	
NORMAL HIGH WATER				
MAXIMUM HIGH WATER			DRIFT AND ICE	
FREQUENCY AND DURATION OF FLOODS				
CHANNEL WIDTH		MINIMUM ELEVATION BOTTOM		
BANKS AND BED				
ALIGNMENT				
PROTECTION WORKS AND RIPRAP				
DAMS				
REMARKS				
SUPPORTING MATERIAL TYPE				
TEST DATA				
FILES TYPE				
SIZE				
LENGTH				
REMARKS				
<small>Patented PAT. APR. 3, '23 FEB. 6, '27 100-C-7594-1A</small>				
STATE HIGHWAY DEPT.		GENERAL CARD		MADE CARD OF
DATE <i>photos 10/9/52</i>		(SEE SPAN CARDS FOR DETAILS)		CHECKED
TOWN	NO.	BRIDGE OVER		TOTAL LENGTH
RATING				
NO.	TYP.			
APPROACH PAVEMENT		SPAN		
DESIGNED BY		GUARD RAIL		
MAINTAINED BY				
PROJECT NO.				
FABRICATOR				
TOTAL COST				
LIGHTING SYSTEM				
BENCH MARK DATA				
TRAFFIC SURVEY DATA				
REMARKS				
SUBSTRUCTURE				
ABUTMENTS				
PIERS OR BENTS				
REMARKS				

N. H. approach Walpole to Westminster Vt.